(2)

REPORT NO. 90-R-02
AFPEA PROJECT NO. 88-P-102

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QUALIFICATION TESTING OF THE COMBAT TALON II VIDEO DISPLAY UNIT CONTAINER

HQ AFLC/DSTZ
AIR FORCE PACKAGING EVALUATION ACTIVITY
Wright-Patterson AFB OH 45433-5999

March 1990

ABSTRACT

Aeronautical Systems Division, ASD/VXAL, requested assistance from the Air Force Packaging Evaluation Activity (AFPEA) to choose an off the shelf container and qualify it for the video display unit (VDU) used on Combat Talon II aircraft.

The container for the VDU is the same as the container for the signal data converter, with the exception of the cushioning system. A new cushioning system was designed to protect the VDU from seeing more then 40 G's during worldwide shipment, storage, and handling.

Since this container had already gone through qualification testing and passed and the difference in the weight of the loads is negligble, the only tests deemed necessary were those testing the fragility of the cushioning system. The tests were performed at the AFPEA, HQ AFLC/DSTZ, WRIGHT-PATTERSON AFB, OH 45433-5999. The results of the tests for the container can be found in AFPEA report number 89-R-09. This container test plan was developed to test the fragility requirements only. The tests were conducted in accordance with Federal Test Method Standard No. 101, and Military Standard 648.

Results of the tests conducted on the prototype container show that the container provides adequate mechanical protection. All container changes and limitations cited in AFPEA report number 89-R-09 for container 11214-8078-400 will apply to this container.

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INTRODUCTION

BACKGROUND: Aeronautical Systems Division (ASD/VXAL), Wright-Patterson AFB OH 45433-5000 requested assistance from the Air Force Packaging Evaluation Activity (AFPEA) to choose an off the shelf container for the video display unit (VDU) and perform qualification testing. The container chosen was a plastic multipurpose container designed by Hardigg Industries, South Deerfield, MA 01373.

PURPOSE: The purpose of this project was to determine if the Hardigg container design will protect the contents, one VDU for Combat Talon II aircraft, during worldwide shipment, storage, and handling.

DESCRIPTION OF TEST CONTAINER

The 1212-1504-8333-202 prototype container, now referred to as -202 was subjected to fragility testing only because the signal data converter container (11214-8678-400), an identical container except for the cushioning system, was subjected to extensive testing (see AFPEA report number 89-R-09). The sides, latches and hinges of the container were numbered counterclockwise from the forward end as shown in figure 1.

Design: The -202 prototype is a controlled-breathing container with a pressure relief valve and humidity indicator (see figure 2). The container is designed to limit the transmission of shocks to the VDU to 40 Gs. The container cover is permanently hinged on one side and five wing latches on the remaining sides allow quick access to the container contents without the use of tools.

Construction: The container is rotationally molded from a formulation of polyethylene. A Type 1, Class 2, Grade C polyurethane foam encapsulates the item (see figure 3). A silicone gasket provides a seal between the container base and the container cover.

TEST OUTLINE AND TEST EQUIPMENT

Test Plan: Tests were conducted in accordance with AFPEA Test Plan 88-P-102 (see table 1). The tests used were selected to meet the qualification requirements for fragility. Test methods, procedures and pass/fail criteria used were as outlined in Federal Test Method Standard No. 101 (FED-STD-101) and Military Standard 648. Any modifications to the standard procedures are noted in the test plan or the results.

Test Load: All tests were conducted using the VDU test load fabricated at the AFPEA. The test load weighs 25 pounds and simulates the center of gravity and the mass moment of inertia of an actual VDU.

Test Site: All testing was conducted at the AFPEA, HQ AFLC/DSTZ, Building 70, Area C, Wright-Patterson AFB OH 45433-5999. The equipment required for each test is noted in the test plan.

TEST PROCEDURES AND RESULTS

Weight Test

Test No. 1: The container was weighed to determine weight compliance.

Results: Total tare weight was 30.0 pounds. The result of this test is acceptable.

Free Fall Drop Tests (+140°F)

Test No. 3: The high temperature free fall drop tests were conducted in accordance with FED-STD-101, Method 5007.1. The height of the drops were 21 inches.

Results: Visual inspection revealed no external damage to the container. A maximum of 34 Gs was obtained during the tests.

The container was opened after the free fall drop tests. Visual inspection revealed no damage to the container or the test load. The results of these tests are acceptable. See appendix 1 for detailed acceleration results.

Free Fall Drop Tests (-20°F)

Test No. 5: The low temperature free fall drop tests were conducted in accordance with FED-STD-101, Method 5007.1. The drop heights were 21 inches.

Results: Visual inspection revealed no external damage to the container. A maximum of 32 Gs was obtained during the tests.

The container was opened after the free fall drop tests. Visual inspection revealed no damage to the container or the test load. The results of this test are acceptable.

Vibration Fatigue Test

Test No. 9: The vibration fatigue test was conducted in accordance with MIL-STD-648, paragraph 5.3.2. The container was rigidly attached to the platform. A sinusoidal vibration excitation was applied in a vertical direction and cyclically swept for 7.5 minutes at 2 minutes per octave to locate the resonant frequency. Input from 5 to 12.5 Hz was at 0.125 inch double amplitude and input from 12.5 to 50.0 Hz was at 1.0 G. A 30 minute dwell test was conducted at the resonant frequency.

Results: Visual inspection revealed no damage to the container or the test load. A maximum of 8.1 Gs was obtained at the resonant frequency of 15.3 Hz. The maximum transmissibility obtained was 4.1. The results of this test are acceptable.

CONCLUSION

The -202 prototype container provided adequate mechanical protection for the contents when tested in accordance with the container test plan.

RECOMMENDATIONS

All recomendations made for the container in AFPEA report number 89-R-09 apply to this container also. The container should have wing latches only, no hinges. Decals on the containers need better adherence for cold temperature environments. Container walls need to be made stiffer for more stability. The container should not be used for long term storage.

AIR FORCE PACKAGING EVALUATION ACTIVITY

(Container Test Plan)

AFPEA PROJECT NUMBER: 88-P-102

CONTAINER SIZE (L x W x D)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU. FT.)	QUANTITY	DATE
	25x25x19	30	25	5.2		20 Feb 90

ITEM NAME: Video Display

MANUFACTURER: Hardigg Industries

CONTAINER NAME:

CONTAINER COST:

PACK DESCRIPTION: Part number: AL1212-1504-8333-200

CONDITIONING: Composite Container

As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRUMENTATION
1.	WEIGHT TEST	Container tare weight should not be less than 30 pounds. Container gross weight should not be less than 55 pounds.	Fully assembled container including shock isolation system.	Scale
2.	FREE FALL DROP TESTS (LOW TEMPERATURE -20°F)			
	FED-STD-101 Method 5007.1 Procedure G	Free fall drop test. Condition at -20°F for not less than 24 hours. Drop height 21 inches. Peak resultant acceleration shall not exceed 40Gs.	See Atch 1. Drop on corners 1 & 7, on side (2,3,7,6) and on the bottom (1,2,3,4). Total of four drops.	Free Fall Drop Tester Tri-axial accelerometers Thermocouples
3.	FREE FALL DROP TESTS (HIGH TEMPERATURE +140°F)			
	FED-STD-101 Method 5007.1 Procedure G	Free fall drop test. Condition at +140°F for not less than 24 hours. Drop height 21 inches. Peak resultant acceleration shall not exceed 40Gs.	See Atch 1. Drop on corners 3 & 5, and side (4,3,8,7) and on the top (5.6,7,8). Total of four drops.	Free Fall Drop Tester Tri-axial accelerometers Thermocouples

COMMENTS:

Caroline Buckey, Mechanical Engineer Ted Hinds, Chief, Design Br., AFPEA

PREPARED BY: Caroline J. Buckey

APPROVED BY: Ted Hinds

AIR FORCE PACKAGING EVALUATION ACTIVITY

(Container Test Plan)

AFPEA PROJECT NUMBER: 88-P-102

CONTAINER SIZE (L x W x D)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU. FT.)	QUANTITY	DATE
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ITEM NAME: Video Display

MANUFACTURER: Hardigg Industries

CONTAINER NAME:

CONTAINER COST:

Part number: AL1212-1504-8333-200

PACK DESCRIPTION: Composite Container

CONDITIONING: As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRUMENTATION
4.	VIBRATION FATIGUE TEST MIL-STD-648 Para 5.3.2	Input excitation of 0.125 inch double amplitude or 1G, whichever is less. Sweep approximately logarithmically from 5 to 50 Hz (about 1/2 octave/min) for 7-1/2 minutes. Then dwell 30 minutes at the resonant frequency. The test may be interrupted to prevent excessive temperature rise in materials. Transmissability shall not exceed 5 at the resonant frequency.	Rigidly attach container to exciter. The use of straps is prohibited.	Triaxial accelerometers, Thermocouples

COMMENTS:

Caroline Buckey, Mechanical Engineer Ted Hinds, Chief, Design Br., AFPEA

PREPARED BY:

APPROVED BY:

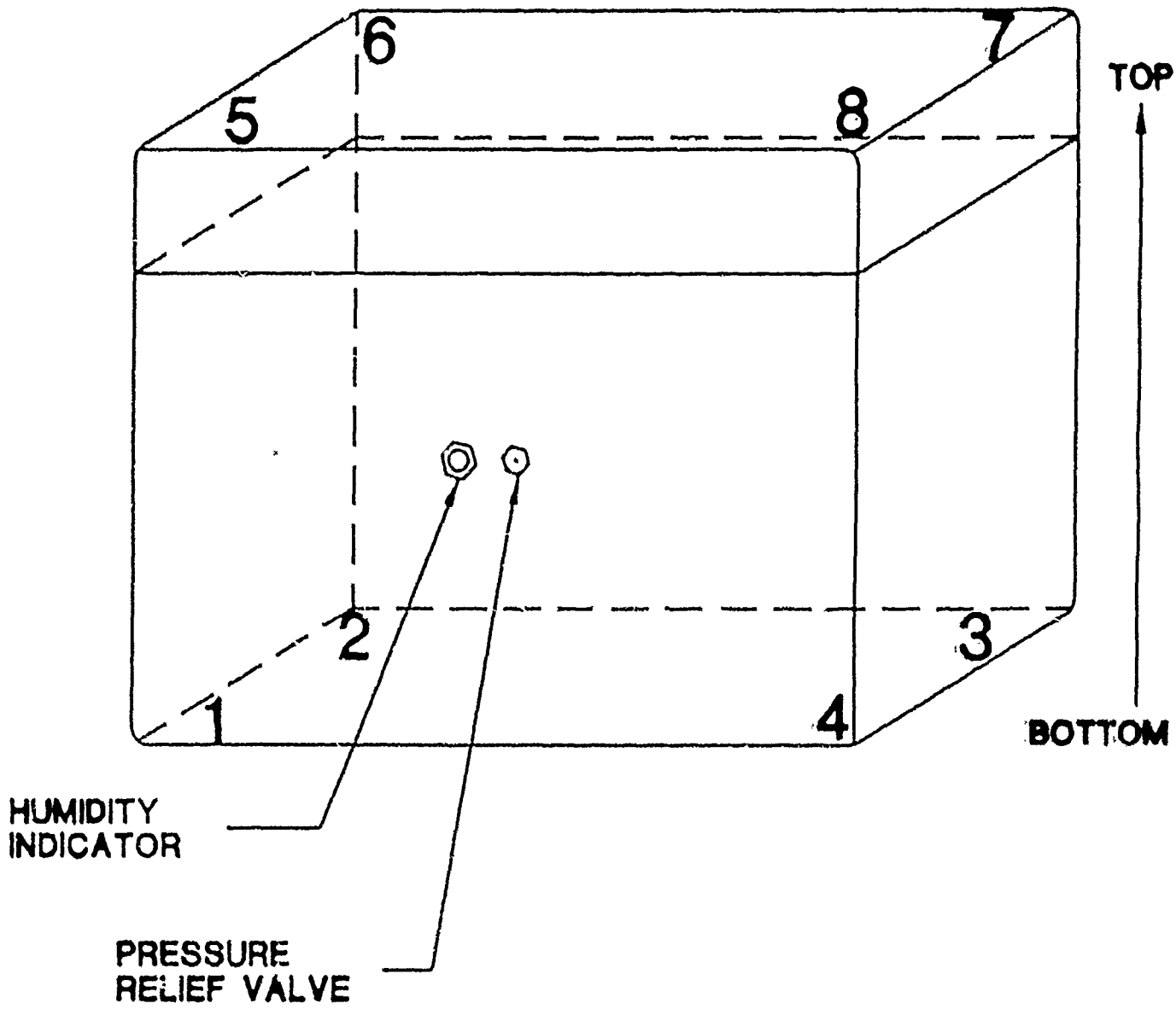

FIGURE 1. -202 Side and Corner Numbering.

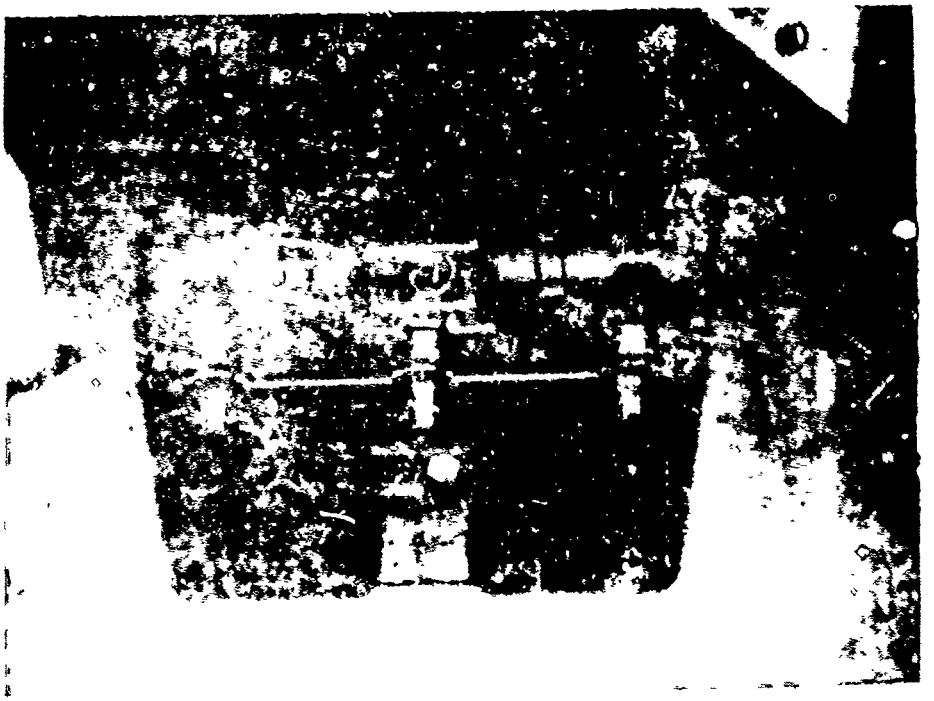

Figure 2

-202
Prototype
Container.

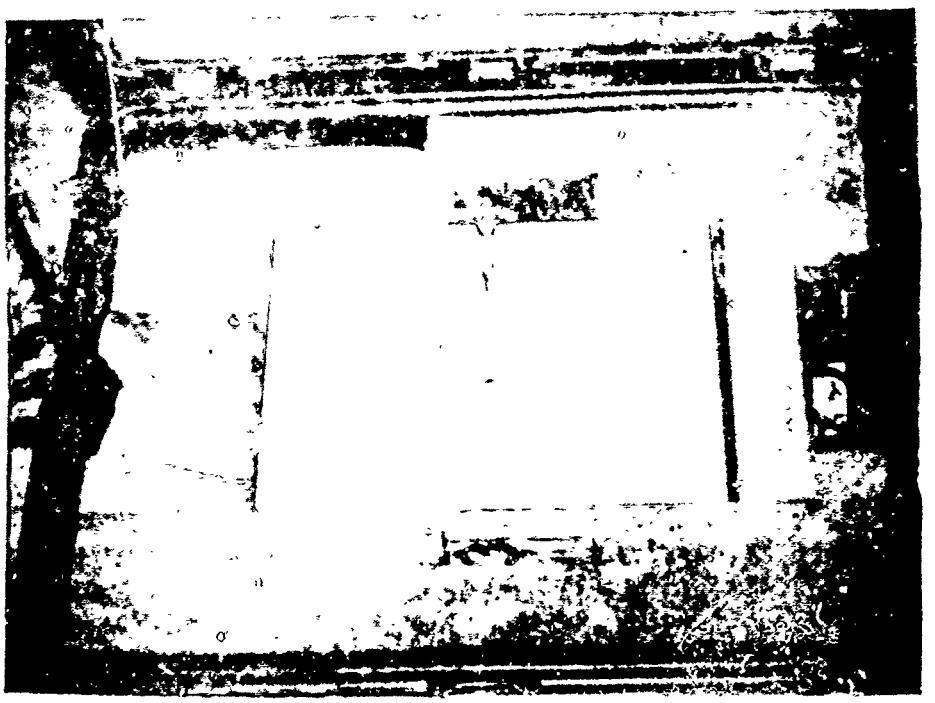

Figure 3

-202
Container
Cushioning.

DISTRIBUTION LIST

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HQ DLA/OWO Cameron Station Alexandria, VA 22304-6145	1
ASD/VXAL Wright-Patterson AFB OH 45433	2
ASD/VXA Wright-Patterson AFB OH 45433	1

-202 CONTAINER - DETAILED ACCELERATION RESULTS

HIGH TEMPERATURE ROUGH HANDLING TESTS (+140° F)

Impact	Position	Accelerometer readings (Gs) Resultant
21" free fall drop	Corner 3	16
21" free fall drop	Corner 5	20
21" free fall drop	Face 5,6,7,8	19
21" free fall drop	Face 3,4,7,8	34

1. No damage to the container or the test load.

LOW TEMPERATURE ROUGH HANDLING TESTS (-20° F)

Impact	Position	Accelerometer readings (Gs) Resultant
21" free fall drop	Corner 1	18
21" free fall drop	Corner 7	21
21" free fall drop	Face 1,2,3,4	6
21" free fall drop	Face 2,3,7,6	21

1. No damage to the container or the test load.

VIBRATION FATIGUE TEST

Natural frequency 15.3 Hz
(input: 1.00 G peak, 0.125 inch double amplitude)

	Resultant
Maximum Acceleration (Gs, peak to peak)	8.1
Maximum Transmissibility	4.1

1. No damage to the container or the test load.